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ABSTRACT

In the past few years, a comprehensive behavioral treatment program has often been the treatment of choice for obesity. The basis for these techniques is the energy balance model of weight control. Obese adults (N=28) completed a 10-week behavioral weight control program and were subsequently monitored during a 2-year follow-up period. During treatment, subjects received a manual describing 12 behaviors designed to facilitate weight loss. Although the results indicated that self-reported compliance with the behaviors was variable, compliance with particular behaviors was significantly related to both treatment and follow-up weight loss. The findings indicate the importance of establishing a negative energy balance; i.e., after initial weight loss has occurred, subjects must continue to monitor their caloric intake. (Author/JAC)

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Weight Loss: Subject Compliance with Prescribed Behaviors

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In the past few years, a comprehensive behavioral treatment program (e.g., Ferster, Nurnberger, & Levitt, 1962; Stuart, 1967) has come to frequently be the treatment of choice for obesity. Most often, the program utilizes multiple components which have been individually shown to result in weight loss, e.g., self-monitoring of caloric intake, or whose inclusion in a weight loss program has been shown to result in greater weight loss than a program without that component. The subject is, thus, offered 10 to 15 behaviors or techniques (or as many as 21 (Jeffery, Vender, & Wing, 1978)) and told that performing these behaviors will result in weight loss. The basis for these techniques is the energy balance model of weight control, i.e., caloric intake - caloric expenditure = weight loss, gain or maintenance (for a thorough discussion see Garrow, 1978) and "the only way to lose body fat is by the establishment of negative energy balance" (Stunkard, 1980, p. 18). Logically, subjects will not utilize all behaviors to an equal degree despite experimenter urgings and exhortations.

However, one might assume that some of these behaviors/techniques will produce or facilitate weight loss. The experimental results have indicated that some techniques are more effective than other techniques. For example, Bellack, Rozensky, and Schwartz (1974) found that a pre-behavioral monitoring group lost more weight than post-monitoring, nonmonitoring or waiting list control groups. Interestingly, post-treatment self-ratings of pro-

gram compliance did not statitically distinguish between groups nor was overall compliance significantly correlated with weight loss. In fact, the use of only one of nine guidelines was significantly correlated with weight loss (Bellack et al., 1974).

Based upon the Bellack et al. (1974) results and other studies, a subsequent report by Brownell and Stunkard (1978) concluded that behavioral programs are effective but "why" remains an open question, i.e., weight change has not correlated with behavior change. Their conclusion was based upon finding only three studies (Hagen, 1974; Mahoney, 1974; Wollersheim, 1970) which reported significant correlations between weight change and prescribed behavior change and each used only a single self-report. Studies using more comprehensive measures of behavior change (Bellack et al., 1974; Brownell, Heckerman, Westlake, Hayes, & Monti, 1978; Jeffery, Wing, & Stunkard, 1978; Stalonas, Johnson, & Christ, 1978) did not indicate that weight change resulted from prescribed behavior change (Brownell & Stunkard, 1978).

Since the Brownell and Stunkard (1978) report, the analysis of program adherence and weight loss has received increased attention (e.g., Johnson, Wildman, & O'Brien, 1980) and become the subject of further debate. In a 1981 review of the behavioral treatment of obesity, Foreyt, Goodrick, and Gotto, stated that it was difficult to attribute improvement to the specific behavioral techniques. In contrast, Lansky (1981) stated that the pes-

simism of Brownell and Stunkard (1978) may have been premature. Further, Lansky (1981) concluded that (1) there is evidence for a relationship between adherence to dietary behaviors and weight loss and (2) the negative findings cited by Brownell and Stunkard may have been due to the methodological shortcomings of the respective studies.

The present paper represents the results of a detailed analysis of subject self-report data from a ten week behavioral treatment program with a 52 week follow-up (Murphy, Williamson, Buxton, Moody, Absher, & Warner, Note 1) and an additional 52 week follow-up. Murphy et al. reported significant weight loss but overall program compliance did not significantly correlate with weight loss. The reanalysis is prompted by issues raised in the Lansky (1981) paper, i.e., the methodological adequacy of measuring overall compliance over all program behaviors. This paper therefore analyzes subject compliance with respect to 12 prescribed weight loss behaviors. Normative data is also presented for the 12 behaviors.

Method

Subjects

Twenty-one women and seven men completed (attended at least nine of eleven weekly treatment sessions) a comprehensive behavioral treatment program for obesity. The mean subject age was

40.3 years with a range of 24 to 60 years. The mean pre-treatment weight was 186.8 pounds (a range of 136 to 258 pounds) and the mean pre-treatment percentage overweight (USDA, 1969) was 43.3% (a range of 21.4% to 78.3%). For the 28 subjects, the mean weight loss during treatment was 16.25 pounds (a range of 5 to 39 pounds lost), through the one year follow-up (N=22) was 12.55 pounds (a range of 17 pounds gained to 42 pounds lost), and through the two year follow-up (N=27) was 6.11 pounds (a range of 34 pounds gained to 27 pounds lost).

Procedure

During the ten week treatment period, each subject received a treatment manual (Williamson & Murphy, Note 2) which described the importance and implementation of 12 behaviors/techniques designed to facilitate weight loss. The 12 behaviors were introduced in a sequential manner and therefore prescribed for different durations. The 12 behaviors were (1) daily charting of weight, caloric intake, and caloric expenditure (9 weeks), (2) eating three daily meals at a designated time (9 weeks), (3) eating three daily meals in a designated place (9 weeks), (4) putting the silverware down between bites during the three daily meals (8 weeks), (5) taking a two minute break after finishing 3/4's of each daily meal (8 weeks) (6)completing records of subject designated problem behaviors/situations (5 weeks), (7) adherence to daily calorie and nutrition contingency contracts (9 weeks),

(8) adherence to daily eating habits contingency contracts (8 weeks), (9) adherence to daily exercise contingency contracts (8 weeks), (10) adherence to daily problem situation contingency contracts (3 weeks), (11) completing daily calorie monitoring sheets (10 weeks), and (12) keeping caloric intake below a designated goal (9 weeks).

Each week subjects received reminder sheets* (see Figure 1) for behaviors 1-10 and calorie monitoring sheets (see Figure 2) for behaviors 11 and 12. The records for each week were collected at the following session. Throughout treatment, the importance of accurate records was emphasized. Subjects who had not obtained their desired weight by the end of treatment were encouraged to continue their weight loss efforts during the follow-up period. However, record sheets were no longer consistently furnished by the experimenter. The maintenance phase of the program involved a programmatic elimination of the record keeping.

Results

Reliability

All reminder sheets and calorie monitoring sheets were reviewed and tabulated by the second author. A second rater randomly selected and tabulated one week of treatment records for each of the 28 subjects. The overall interrater reliability, number of

* The reader will note that the "snack" data was not analyzed. This is because snacks were optional and, therefore, highly variable across subjects.

REMINDER SHEET

Name _____ Week Beginning _____

Ending _____

							DAY OF WEEK
Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	Y N Y N Y N	DAILY WEIGHT CHART DAILY INTAKE CHART DAILY EXERCISE CHART
Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Breakfast Lunch Dinner Snacks — INTAKE AT DESIGNATED TIME
Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Breakfast Lunch Dinner Snacks — INTAKE IN DESIGNATED PLACE
___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	___ ___ ___ ___	Breakfast Lunch Dinner Snacks — EAT SLOWLY; FORK DOWN BETWEEN BITES Write in: 0- 0-25% of bites 1-26-50% of bites 2-51-75% of bites 3-76-100% of bites
Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Breakfast Lunch Dinner Snacks — TWO MINUTE BREAK AFTER 3/4's OF MEAL
Y N	Y N	Y N	Y N	Y N	Y N	Y N	BEHAVIOR RECORD
Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Y N Y N Y N Y N	Calorie & Nutrition Eating Habits Exercise Problem Situation — CONTRACTS KEPT

*Y signifies yes and N signifies no

Figure 1

Name _____ Date _____

Calorie Goal: 1350 Calories

DAILY CALORIC INTAKE RECORD

	Time	Place	Circumstances	Food	CALORIES Meat	Cereal	Milk	Veg	Fruit	Misc	Total
Morning					75	70			40	40	
						70				40	
Afternoon					75	70	85		40	40	
					75	70			40	40	
Evening					75	70	85	15	40		
					75			15			
					75			15			

Figure 2

agreements/ number of possible agreements (12 behaviors for 28 subjects) x 100%, was 97.3%. The range for individual subjects was 75% (n=1) to 100% (n=21).

Compliance

During the ten week treatment period, subject compliance was computed for 253 of 280 (12 behaviors over 10 weeks for 28 subjects) weekly subject behaviors which represents a return rate of 90.4%. During the first one year follow-up period, while subjects were encouraged to record behavioral compliance, reported compliance was highly variable between subjects, ranging from 0 to 45 weeks. Mean percentage compliance values during treatment and follow-up (one year) are presented in Table 1 for all subjects (N=28). As can be seen in Table 1, treatment compliance with the prescribed behaviors was variable, ranging from 58% to 98%, but consistently above 50%. During follow-up, reported compliance markedly decreased to a range from 12% to 24% for the 12 behaviors.

Treatment and follow-up compliance was analyzed with a stepwise regression and a .1500 significance level for a behavior to be entered into the regression model (Statistical Analysis System, 1979). The dependent variables were weight loss during (1)treatment, (2) the two year follow-up, and (3) treatment and follow-up. During treatment, three behaviors, having caloric intake below a subject designated goal, taking a two minute break after 3/4's of the meal, and putting the silverware down between bites, accounted

Table 1

Compliance with Prescribed Weight Loss Behaviors

Behavior	Treatment Compliance: Mean % Compliance	Treatment Compliance: % Variance Treatment Weight Loss	Treatment Compliance: % Variance Follow-Up Weight Loss	Treatment Compliance: % Variance Treatment and Follow-Up Weight Loss	Follow-Up Compliance: Mean % Compliance	Follow-Up Compliance: % Variance Follow-Up Weight Loss	Follow-Up Compliance: % Variance Treatment and Follow-Up Weight Loss
Daily weight, intake, & expenditure graphs	83.39		+15.76*	+11.56	19.83	++53.21**	++40.65**
Eating daily meals at designated time	77.83				18.97		
Eating daily meals in designated place	78.10				18.88		
Putting silverware down between bites	76.15	+++31.23*		++++34.69*	17.58		
Two minute break after 3/4's of meal	76.97	++24.46*			15.82		
Recording problem behaviors/situations	60.71				11.64	+++61.95**	
Daily calorie and nutrition contract	69.16				14.43		
Daily eating habits contract	66.33				15.48		+++48.30**
Daily exercise contract	69.01			+++27.38	15.27	++++66.96**	
Daily problem situation contract	58.84				11.97		
Daily calorie monitoring	98.37			++20.34	24.35	+14.37	+13.79
Caloric intake below goal	74.29	+13.68*			17.57		

% Variance includes preceding extracted variables

\+ First variable extracted in stepwise regression (.1500 significance level for entry)

++ Second variable; +++ Third variable; ++++ Fourth variable

* $p < .05$; ** $p < .01$

for 31% of the treatment weight loss variance, $\underline{F}$ (3,24) = 3.63, $p < .03$. Similarly, treatment compliance with four weight loss behaviors, graphing daily weight, intake, and expenditure, monitoring daily caloric intake, compliance with the exercise contingency contract, and putting solverware down between bites, accounted for 34% of the overall (treatment and the two year follow-up) weight loss variance, $\underline{F}$ (4,22) = 2.92, $p < .05$

Self-reported compliance during the one year follow-up was significantly related to both follow-up (two year) weight loss, $\underline{F}$ (4,16) = 8.11, $p < .001$, and total weight loss, $\underline{F}$ (3,17) = 5.29, $p < .01$. The behaviors were, however, different except that the first two entries, monitoring daily caloric intake and graphing daily weight, intake, and expenditure, were the same in both instances.

Discussion

The results of this study suggest that subject compliance with prescribed weight loss behaviors is associated with succesful weight loss both during treatment and follow-up. While treatment compliance was variable, for 7 of the 12 behaviors compliance was above 70%. Further, the first behavior used in the stepwise regression for treatment weight loss was maintaining caloric intake below a designated goal. This finding indicates the importance of establishing a negative energy balance if weight loss efforts are to actually result in weight loss. The follow-up compliance data indicates that after weight loss has occurred, subjects must continue to monitor their caloric

intake for successful weight loss maintenance, i.e., daily caloric monitoring was the first behavior in the regression.

The second major finding of the present study is the importance of graphing daily weight, caloric intake, and caloric expenditure. In four of the five analyses, graphing was the first or second behavior in the regression. This finding suggests that when subjects are able to monitor the daily fluctuations in weight, intake, and expenditure, they can take appropriate corrective action on following days.. Subjects,thereby,avoid weight gain.

Despite the significant results of the present report, one potential shortcoming needs to be mentioned. The compliance data is based entirely upon self-reported compliance. Aside from problems inherent in self-report data, the present authors made the assumption that if subjects did not report performing the behaviors then they did not perform the behaviors. While this might be a questionable assumption, particularly during follow-up, the authors believe that motivated subjects who performed the behaviors, also reported such performance. Consequently, the present study provides further evidence (see Lansky, 1981) that weight loss is significantly affected by compliance with prescribed weight loss behaviors.

Reference Notes

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[2] Williamson, D., & Murphy, J. A systematic, behavioral approach to weight loss and maintenance. Unpublished manuscript, Louisiana State University, 1979. (Available from Donald A. Williamson, Department of Psychology, Louisiana State University, Baton Rouge, Louisiana 70803).

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